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Portable 4-Channel Laser Source Instrument in Small Benchtop

User Manual

(QLDS-N series, version 1.0a. March 26, 2014)

Safety Warning

Do not under any circumstances look at the output of the unit through collimating or focusing optics unless the unit is turned off ! Do not look into the end of an optical cable attached to the optical output when the device is operational.

The invisible laser radiation of this optical instrument will increase eye hazard. Use the utmost care when changing, inspecting, or cleaning any optical connectors. Do not enable the laser when there is no fiber attached to the optical output connector.

The laser is enabled by pressing the 'Enable Laser' button above the optical output connector on the front panel of the instrument. The laser is on when the green LED on the front panel of the instrument is lit.

Laser Safety and Electrical Compliance

- Class 1 laser product for standard products. Max permissible output power around 1550nm: 136mW. Max wavelength range : 1525-1565nm. (Exception: Class 1M for customized 20mW laser)
    - Complies with IEC 60825-1, 60825-2 laser safety standards.
    - Complies with 21 CFR 1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.
- Complies with CE and other standards for electrical safety and EMI. The external AC-DC power supply comes with safety certificate from manufacturer. The instrument only needs low voltage 12 VDC power supply.

While standard output sources fall within the class 1 laser rating (Class 1M for customized 20mW lasers), the system was designed to meet 3B laser class requirements. The power switch is a keylock system to prevent accidental or unwanted use. Each source has its own enable button allowing the user to choose the light source they wish to be active. Each channel includes a green LED indicator to easily determine its current state. There are also aperture label and laser warning label.

Description

Portable stabilized 4-Channel Light Source Instrument comes with 4 laser and/or LED-broadband-light source output channels, choosing from DWDM lasers or non-DWDM light sources.

Small, light, portable, and also benchtop. It can be placed on either low workbench or high shelf.

Stabilized and low-noise laser driving and applicable temperature control circuitry.

DWDM laser source features

- 5mW stabilized output. 1mW version is also available. Both are based on high-reliable JDS or Lucent laser and telecom-grade circuitry. Higher power is available at longer lead time.
- Any wavelength of C-band ITU DWDM 100GHz channels is available, most wavelengths are in stock.
- Wavelength tunable over two 100GHz-spaced channels (n,n-1), by pressing the button switch on front panel
- Very stable output power. Automatic power control
- Temperature controlled cooled laser.
- 9/125um singlemode fiber.
- Integrated optical isolator
- Typical 2MHz - 5MHz narrow-linewidth

Note: DWDM 3mW 1559.79nm DFB laser, is uncooled and does not offer features above. Customized 1mW, 5mW, 10mW, 20mW laser sources do not support wavelength selection over 2 channels.

Non-DWDM light source features

- Low cost
- lower output power
- still stabilized power by APC loop, but less power stability since there is no TEC mostly.
- less wavelength accuracy since there is no temperature controller mostly

Choosing from following light source:

- 0.85um MMF laser in ST adapter
- 1.31um MMF LED in ST adapter
- 1.31um MMF FP laser in ST adapter
- 1.31um SMF FP laser in FC adapter
- 1.31um SMF DFB laser in FC/PC or FC/APC adapter
- 1291nm - 1611nm CWDM wavelength SMF DFB laser in FC/PC or FC/APC adapter
- 1.49um SMF DFB laser in FC/PC or FC/APC adapter
- 1.51um SMF DFB laser in SC/APC adapter
- 1.55um SMF DFB laser in FC/PC or FC/APC adapter.
- 1.55um SMF LED broadband source, in FC/PC or FC/APC adapter.

Front panel:

- 4 fiber adapters on front panel. Fiber adapter options:
  - 4 FC (any combination of FC/APC and FC/PC)
  - 2 ST, 2 FC (any combination of FC/APC and FC/PC).
  - 4 SC (any combination of SC/APC and SC/PC). It can be for any laser/LED source.
  - 1 ST, 3 FC (any combination of FC/APC and FC/PC).
  - Duplex LC (we modify from SC interface by adding a label and unused adapter, then front panel does not look so good).
- Power-on keylock switch, Power-on green LED.
- Individual Laser-enable button switch, Laser-enable green LED, in each channel
- In each DWDM channel, there is also an individual "λ+0.8nm" button switch, "λ+0.8nm" LED, "λ alarm" LED.

Rear panel: 9 – 18 V 1A DC input. Typical 12V 1A.

The product comes with small external wall-mount power supply, its AC plug type will fit the wall socket of AC voltage in your country. Input : 100-240VAC, 47-63Hz. Please tell us your preferred AC plug type. Our available AC power plug types are A, C, G, I (see 5th-9th photos below). Type A (see 5th, 6th photos at website) is most popular one, used in North and Centra America, China, Japan, Taiwan, and Thailand. We will give you type A power supply by default. We can give you all four types, but we may have to change to a little larger packing box with little higher shipping fee.

Overall dimension: 21x21X8 cm (excluding power supply). 32x27x14 cm packed.
Net weight: about 1.6kg (including power supply)

Enclosure material: Aluminum at rear panel and side extrusions, steel at top and bottom covers, copper at front panel. So whole enclosure is EMI shielded, only with several small holes at front/rear panels. Two plastic bezels over front and real panels for nice look and protection.

Standard operating temperature: from 10 to 40 °C degree. It can be extended to from -15 to 70 °C degree upon request.

Standard package includes:

- Enclosure with laser modules.
- One wall-mount power supply (AC plug is type A for most countries).
- One FC/UPC-FC/UPC (UPC is compatible with PC) fiber jumper for each laser channel. (Or other connector type to match the front panel adapter).
- One FC adapter for each laser channel. (Or other adapter type to match the front panel adapter).
- Small qty of swabs to clean internal fiber connectors at front panel (Wilshire PN:1002).
- Our test data of output power and wavelength after at least 30 minutes warm-up.

Inspection

Before shipment, this unit has been found to be free of defects. The instrument's model/part number, serial number, and configuration are found on a label located on the back of the unit. The instrument's history is filed at the factory by part number and serial number.

Assembling Instrument after you receive the instrument

- Connect each fiber patchcord to the adapter on front panel. **(Please Do Not screw FC connector into FC adapter very hard which may make connector dirty ! Please always keep fiber jumpers connected on front panel adapters).** Put on the adapter at other end on each fiber jumper.
- Plug in the wall-mount power supply.

Getting Started

- Insert the key into key-lock switch on front panel.
- Turn on the key-lock switch on front panel.
- Press "EDFA ENABLE" button on front panel.

Cleaning optical connectors

After optical connectors plug in and pull out many times on adapters, the connector may not be easily cleaned, so we highly recommend that you always keep external fiber jumpers connected on front panel, and only clean the jumper connectors of far ends. You may need clean internal connectors on front panel in future, please use Fiber Optic Cleaner Pen (designed to clean the internal connector through the adapter of equipment panels).

Warranty: one year after delivery. See http://www.lightwavestore.com/warranty%20and%20technical%20support.htm

Note: Never open the instrument enclosure, or warranty will be voided.

Configuring a 4-channel source

You need choose one controller unit and 1 to 4 lasers from the table at the end of description.

1. Add controller unit only without laser/light source: $370 to shopping cart.

Fiber adapter options:

a). 4 FC.

b). 2 ST, 2 FC.

c). 4 SC (any combination of PC or APC). SC/APC is only available for single-mode fiber.

d). 1 ST, 3 FC.

f). Other adapter types and combinations (longer lead time may apply).

Note: FC can be any combination of FC/APC and FC/PC. FC/APC may not be available for multimode fiber.

2. Please choose individual lasers from channel 1 to channel 4.

Example A (in stock, ship same or next day): Add a controller, 0.85um MMF laser source, 1.31um MMF FP laser, 1.31um SMF DFB laser source, and 1.55um SMF DFB laser source to webstore shopping cart, then you will get 4-channel laser source instrument with total cost $370+$50+$100+$150+$150=$820. See the 4th photo below in website.

Example B (in stock, ship same or next day): Add a controller, 4 CWDM lasers to webstore shopping cart, then you will get 4-channel laser source instrument with total cost $370+4x$200 = $1170 (extra $80 if you choose 1551nm).

Example C (in stock, ship same or next day): Add a controller, 1554.13nm type-A DWDM 7dBm laser to webstore shopping cart, you will get 1-ch laser source instrument with total cost $370+$475 = $845.

Example D (in stock, ship same or next day): Add a controller, 27, 1555.75nm type-B and 1562.23nm type-A DWDM 7dBm lasers to webstore shopping cart, then you will get 2-channel laser source instrument with total cost $370+$580+$460 = $1410.

Example E (ship in 3 day): Add a controller, 1562.23nm, 1550.12nm, 1540.56nm, 1531.9nm DWDM 7dBm lasers to webstore shopping cart, then you will get 4-channel laser source instrument with total cost $370+$460+$520+$460+$460 = $2270. (Almost same as 1st two photos below except the adapter shape is square).

Example F (ship in 3 day): Add a controller, 0.85um MMF laser source, 1.31um SMF DFB laser, 1.49um SMF FP laser source, and 1.55um SMF DFB laser source to webstore shopping cart, then you will get 4-channel laser source instrument with total cost $370+$50+$100+$150+$150=$820.

Note: One laser instrument offers 4 output channels by default. If you leave some channel blank, no fiber adapter will be installed for that channel. The instrument will be shipped without a laser in that channel. Fiberprime may fill the empty slot at a later date if you desire.

Light Source	Cost $	Center wavelength range (nm)	λ Accuracy (nm)	Average optic power output (dBm) Min	Typic	Max	(fixed amb. T, ±1 ºC) (1h warm-up) Power stability 15min (dB)	8h (dB)	Linewidth (nm)	With TEC ?	Select λ over 2-ch ?	Built-in optical isolator ?
0.85um MMF vcsel laser	+50	830 - 860		-9		-3.5	<0.02		<0.85	No	No	No
1.31um MMF LED	+100	1270-1380		-19		-14			58 typ.rms	No	No	No
1.31um MMF FP laser	+100	1274-1356		-15		-8			<2.5 (rms)	No	No	Yes/No
1.31um SMF FP laser	+100	1274-1356		-15		-8			<2.5 (rms)	No	No	Yes/No
1.31um SMF DFB laser	+100	1280-1335		-3	0.5	2	<0.02		<1 (-20dB)	No	No	No
1.49um SMF DFB laser	+200	1480-1500		1.5		4.5			<1 (-20dB)	No	No	Yes
1.49um SMF FP laser	+150	1480-1500		-9		-3			<5.5 (rms)	No	No	No
1.51um SMF DFB laser	+300	1502-1518		-3	-1	2				Yes	No	No
1.55um SMF DFB laser	+150	1530-1562		-2	0.5	3			<1 (-20dB)	No	No	Yes
1.55um SMF LED(cheap)	+220	1.55um			-16		not stabilized powe		45 typ.	No	No	No
1.55um SMF LED(stable)	+420	1.55um			-16		stabilized power		45 typ.	No	No	No
CWDM SMF DFB laser	+200	1291-1611	±6.5 (1.5 typ)		>0.5		0.03		<0.7(-20dB	No	No	Yes
DWDM 3mW DFB laser	+250	1559.79	0.015 typ.		>4		0.001 typ.			No	No	Yes
DWDM 1mW DFB laser Type A.	+360	C-band	λ-λ_{ITU} <0.130		1	2			<10	Yes	Yes	Yes
DWDM 5mW DFB laser Type A. Less acurate λ	+460	C-band	λ-λ_{ITU} <0.130	6	7	8	<0.004 typ.	<0.01 typ.	<10	Yes	Yes	Yes
DWDM 5mW DFB laser Type B. More acurate λ	+580	C-band	λ-λ_{ITU} <0.065	6	>6.5	7			<10	Yes	Yes	Yes
DWDM 1mW DFB laser Type C. Most acurate λ	+530	C, L-band	λ-λ_{ITU} <0.03		1				<10	Yes	No	Yes
DWDM 5mW DFB laser Type C. Most acurate λ	+630	C, L-band	λ-λ_{ITU} <0.03		7				<10	Yes	No	Yes
DWDM 10mW DFB laser Type C. Most acurate λ	+740	C, L-band	λ-λ_{ITU} <0.03		10				<10	Yes	No	Yes
DWDM 20mW DFB laser PM fiber. Most acurate λ	+850	C, L-band	λ-λ_{ITU} <0.03		13				<10	Yes	No	Yes

Note 1: Lasers with TEC will offer faster warm-up and better power/wavelength stability.

Note 2: For 1.55um 0dBm non-DWDM DFB lasers, the wavelength specification is 1500-1580. But we will pick wavelength within C-band 1530-1562nm.

See detailed available qty and price in the table at the end of website description. For example, price of DWDM 5mW DFB lasers around 1550nm is higher than $460, CWDM laser around 1551nm is over $200. Other CWDM wavelengths might be available, but takes longer time and may apply higher price.

Each DWDM laser channel of standard products actually can cover two 0.8nm-spaced wavelengths by pressing "lambda+0.8nm" on front panel, so most of ITU wavelengths are in stock. If you cannot see required wavelength, we can get for you in a few days(e.g., 5mW ch 21, 23, 26, 50, 53, 55; 1mW ch25). The price would be different depending on our suppliers and shipping cost. We can also make customized wavelength for you at longer lead time and extra cost.

Optical Specifications of Standard DWDM DFB Laser

Parameter	Symbol	Minimum	Typical	Maximum
Average optical power output [1,2] Default 5mW version 1mW low power version	Pavg	 6 dBm -0.5 dBm	 7 dBm 1 dBm	 8 dBm 2.0 dBm
Power stability (after 1 hour warm-up) [2] 15min (ambient T = constant) 8h ($\Delta T = \pm 1$ ºC)			 0.004 dB	 0.01 dB 0.03 dB
Center wavelength range		1528.77 nm	-	1563.86 nm
Center wavelength accuracy [2] Type A laser Type B laser		 -20 pm -20 pm	 90 pm 20-45 pm	 130 pm 65 pm
Wavelength stability [2] (after 10 minutes warm-up)			2 pm	
Side-mode Suppression Ratio [1]	SMSR	30 dB		
Line Width (3dB full width)			2-5 MHz	10 MHz
Optical isolation[3]		30 dB	35 dB	50 dB

Note [1]: Output power definitions and measurement per ITU-T recommendations G.957.

Note [2]: Minimum and maximum parameters are specified at room temperature.

Note [3]: Upon your request, we can add extra isolator if you need keep stable output power in special environment. When you test laser output power by some type of optical power meter (such as optical head), 4% optical power would be reflected back to laser and may make laser power less stable. According to our test, the last digit in power meter (0.001dB resolution in HP 8153A meter) may randomly oscillate and tester may not be able to read last digit easily. Choosing fiber angled APC connector or adding extra isolator can significantly improve power stability.

Ordering Information

Part number: QLDS-N-WL1/P1-WL2/P2-WL3/P3-WL4/P4-A1-A2-A3-A4
N: total channel count, from 1 to 4
WL1: channel number or wavelength of output 1. P1: channel 1 output power in dBm
WL2: channel number or wavelength of output 2. P2: channel 2 output power in dBm
WL3: channel number or wavelength of output 3. P3: channel 3 output power in dBm
WL4: channel number or wavelength of output 4. P4: channel 4 output power in dBm
A1 to A4: FP for FC/PC, FA for FC/APC, SP for SC/PC, SA for SC/APC, LP for LC/PC interface, from ch1 to ch4.

Example:

- Part number for two lasers (type-A 7dBm 1531.12nm ITU-ch58, type-B 7dBm 1541.35nm ITU-ch45) with FC/APC interface: QLDS-2-58/7A-45/7B-FA-FA .
- Part number for four lasers (-10dBm 0.85um MMF laser, 0dBm 1.3um MMF FP laser, type-A 7dBm 1531.12nm ITU-ch58, type-B 7dBm 1541.35nm ITU-ch45) with two ST adapters for ch1 and ch2, two FC/PC adapters for ch3 and ch4: QLDS-4-0.85/-10-1.31MFP/0-58/7A-45/7B-ST-ST-FP-FP.

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Appendix

CWDM SMF DFB laser available wavelengths and qty on Sept. 26, 2013:

WL (nm)	Qty
1611	12
1591	11
1571	10
1551	2
1531	16
1511	26
1491	15
1471	14
1451	46
1431	9
1371	6
1351	4
1331	1
1291	4

Note: Wavelength accuracy specification of CWDM DFB laser is max +/-6.5nm, typical +/- 1.5nm.

Type-A DWDM 5mW DFB laser available qty on Sept. 26, 2013:

ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty		ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty
17	1563.86	191.7	0		40	1545.32	194	0
18	1563.05	191.8	0		41	1544.53	194.1	0
19	1562.23	191.9	55		42	1543.73	194.2	11
20	1561.42	192	0		43	1542.94	194.3	0
21	1560.61	192.1	wait		44	1542.14	194.4	5
22	1559.79	192.2	51		45	1541.35	194.5	0
23	1558.98	192.3	wait		46	1540.56	194.6	1
24	1558.17	192.4	14		47	1539.77	194.7	9
25	1557.36	192.5	0		48	1538.98	194.8	1
26	1556.55	192.6	wait		49	1538.19	194.9	13
27	1555.75	192.7	13		50	1537.4	195	1
28	1554.94	192.8	0		51	1536.61	195.1	0
29	1554.13	192.9	30		52	1535.82	195.2	5
30	1553.33	193	0		53	1535.04	195.3	wait
31	1552.52	193.1	0		54	1534.25	195.4	5
32	1551.72	193.2	3		55	1533.47	195.5	wait
33	1550.92	193.3	1		56	1532.68	195.6	5
34	1550.12	193.4	30		57	1531.9	195.7	28
35	1549.32	193.5	2		58	1531.12	195.8	0
36	1548.51	193.6	1		59	1530.33	195.9	44
37	1547.72	193.7	15		60	1529.55	196	0
38	1546.92	193.8	0		61	1528.77	196.1	0
39	1546.12	193.9	1		62	1527.99	196.2	0

Type-B DWDM 5mW DFB laser available qty on Sept. 26, 2013:

ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty		ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty
17	1563.86	191.7	0		40	1545.32	194	0
18	1563.05	191.8	0		41	1544.53	194.1	0
19	1562.23	191.9	21		42	1543.73	194.2	16
20	1561.42	192	0		43	1542.94	194.3	0
21	1560.61	192.1	0		44	1542.14	194.4	17
22	1559.79	192.2	50		45	1541.35	194.5	0
23	1558.98	192.3	0		46	1540.56	194.6	0
24	1558.17	192.4	14		47	1539.77	194.7	7
25	1557.36	192.5	0		48	1538.98	194.8	0
26	1556.55	192.6	0		49	1538.19	194.9	3
27	1555.75	192.7	50		50	1537.4	195	0
28	1554.94	192.8	0		51	1536.61	195.1	0
29	1554.13	192.9	32		52	1535.82	195.2	4
30	1553.33	193	0		53	1535.04	195.3	0
31	1552.52	193.1	0		54	1534.25	195.4	20
32	1551.72	193.2	47		55	1533.47	195.5	0
33	1550.92	193.3	0		56	1532.68	195.6	0
34	1550.12	193.4	63		57	1531.9	195.7	25
35	1549.32	193.5	0		58	1531.12	195.8	0
36	1548.51	193.6	0		59	1530.33	195.9	17
37	1547.72	193.7	19		60	1529.55	196	0
38	1546.92	193.8	0		61	1528.77	196.1	0
39	1546.12	193.9	3		62	1527.99	196.2	0

DWDM 1mW DFB laser available qty on Sept. 26, 2013:

ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty		ITU Channel	Wavelength (nm)	Frequency (THz)	Avail Qty
17	1563.86	191.7	0		40	1545.32	194	0
18	1563.05	191.8	0		41	1544.53	194.1	0
19	1562.23	191.9	0		42	1543.73	194.2	0
20	1561.42	192	0		43	1542.94	194.3	0
21	1560.61	192.1	0		44	1542.14	194.4	1
22	1559.79	192.2	0		45	1541.35	194.5	0
23	1558.98	192.3	0		46	1540.56	194.6	0
24	1558.17	192.4	0		47	1539.77	194.7	0
25	1557.36	192.5	0		48	1538.98	194.8	0
26	1556.55	192.6	0		49	1538.19	194.9	0
27	1555.75	192.7	11		50	1537.4	195	0
28	1554.94	192.8	2		51	1536.61	195.1	0
29	1554.13	192.9	25		52	1535.82	195.2	0
30	1553.33	193	0		53	1535.04	195.3	0
31	1552.52	193.1	26		54	1534.25	195.4	0
32	1551.72	193.2	0		55	1533.47	195.5	0
33	1550.92	193.3	0		56	1532.68	195.6	1
34	1550.12	193.4	0		57	1531.9	195.7	0
35	1549.32	193.5	38		58	1531.12	195.8	12
36	1548.51	193.6	2		59	1530.33	195.9	0
37	1547.72	193.7	0		60	1529.55	196	1
38	1546.92	193.8	0		61	1528.77	196.1	0
39	1546.12	193.9	0		62	1527.99	196.2	0